CALFED DIVERSION EFFECTS ON FISH TEAM
Subcommittee on Harvest Management

Draft dated September 17, 1998

An interagency and stakeholder committee was formed to address the technical issues related to harvest management and species recovery under the CalFed Bay Delta program. The general objectives of the work group included:

- Review ocean harvest management and possible actions that could assist with species recovery.
- Determine what percentage ocean harvest could contribute to recovery.

The DEFT also provided more specific objectives for the work group to complete:

- Determine the relationship between the Central Valley Harvest Rate Index and actual harvest rates.
- Summarize existing fishing regulations.
- Identify potential additional harvest management actions over the next seven years.
- Evaluate cohort replacement rates as a tool to gage species recovery.
- Provide an assessment of how fishing regulatory actions would contribute towards species recovery.

To develop the information requested by the Diversion Effects on Fish Team (DEFT) a work group was formed that consisted of the following agency/stakeholder representatives:

Joe Miyamoto (Acting Chair), East Bay Municipal Utility District
Dan Viele, National Marine Fisheries Service
Gary Stern, National Marine Fisheries Service
LB Boydstun, California Department of Fish and Game
Alan Baracco, California Department of Fish and Game
Zeke Grader, Pacific Coast Federation of Fishermen's Association
Bill Kier, Consultant for Pacific Coast Federation of Fishermen's Association
Peggy Beckett, Golden Gate Fishing Association
Roger Thomas, Charter Boat Fishing Association
Rick Sitts, Metropolitan Water District of Southern California
Jim Buell, Consultant for Metropolitan Water District of Southern California
Terry Mills, CalFed staff
Serge Birk, Central Valley Project Water Association

The work group held two meetings on August 27, 1998 and September 4, 1998 at the Resources Building in Sacramento.

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The Harvest Management Issues

The work group was referred to the Bay-Delta Oversight Council briefing paper on harvest management for a summary of the major issues. The primary issues identified in the BDOC paper include the following:

- The identification of the origin and race of any individual ocean caught salmon is problematic and there are no distinguishing characteristics to do so.
- The age structure has changed from spawning runs dominated by four- and five-year old fish to the present dominance of three-year old fish. This change in age structure has diminished the reproductive potential of the stock because egg production increases with age. Older fish are substantially more vulnerable to the fishery and have a higher harvest rate.
- The annual harvest rate index used by the Pacific Fishery Management Council (PFMC) has fluctuated between 0.40 and 0.80 over the past 40 years. A PFMC science team in reviewing harvest data, concluded that an increasing trend of harvest may bring the harvest to a level that could not be sustained.
- There is disagreement among fishery experts over the cause of salmon abundance fluctuations in the San Joaquin system. Some experts argue that San Joaquin runs have declined because of overharvest while others point out that population spikes have occurred independent of dramatic decreases in harvest and are responsive to more suitable habitat and hydrologic conditions. Other experts feel this is not the case without some key consistency in relationships using total production rather than just spawning escapement.
- Winter-run chinook salmon have declined despite harvest rates of only one-third the rate of fall-run chinook salmon causing some fishery experts to believe the declines are related to habitat changes.
- Major variations in survival can also be tied to ocean conditions.
- The commercial and sport harvest of salmon is large enough to have a substantial effect on spawning escapement.
- Trends of increased harvest rates, decreased average age of spawners, and failure to meet spawning escapement goals raise "serious questions and concern" if the salmon stocks are being overharvested. The BDOC report states: "At a minimum, the evidence would seem to dictate a need for more effective regulation of harvest to meet spawning escapement goals."

Current Management Authority and Process

The existing harvest management regulatory process is under several state and Federal authorities including the State Legislature, Fish and Game Commission, Pacific Fishery Management Council, and Endangered Species Act. In California, the Fish and Game Commission regulates the sport harvest while the legislature regulates the commercial harvest through the Director of the Department of Fish and Game. The US Department of Commerce regulates the ocean harvest to protect species within the Federal fishery management and conservation zone. The PFMC is made up of representatives from the

resource agencies and the commercial and recreational fishing interests. The Endangered Species Act (ESA) provides an umbrella management authority over the other regulatory processes.

The CVI has not constrained the ocean fisheries. The ocean troll fishery has been restricted by regulations to protect weak Oregon coho stocks and to allocate catch for tribal harvests of Klamath River chinook salmon. The sport fishery has been constrained by size limits and time and area closures to protect two-year-old winter run chinook salmon. These restrictions have protected other Central Valley stocks that need focused attention such as San Joaquin fall-run and spring-run chinook salmon.

The Fisheries Management Plan provides for a Central Valley wide spawning escapement goal of between 122,000 to 180,000 adult salmon. The harvests are set on the basis of a CVI model which predicts the adult return from the previous years jack counts.

Because of increasing restrictions on the ocean fishery, the number of active salmon trollers has greatly decreased. Those troll vessels that accounted for 90% of the landings has decreased from 2,000 vessels in 1978 to less than 400 in 1997. The ratio of commercial to sport landings is three to one. The recreational harvest targets two-year old fish while the commercial catch targets three-year olds salmon.

Central Valley Harvest Rate Index

The work group discussed the relationship between the Central Valley Index and actual harvest rates. Catches which are a part of the index include only those catches south of Point Arena, although historically, over one-half of the harvest may have occurred in this area. In addition, ocean conditions such as El Nino may distribute the Central Valley stocks so they are more vulnerable to Oregon fisheries. Given these factors, the catch used in the CVI Harvest Rate may be low compared to the actual harvest.

The spawning escapements used in the index include both hatchery and wild or natural salmon stocks. However, not all escapements from Central Valley streams are incorporated in the index.

There have been several attempts to compute true harvest rates. Robert Cope in his PhD thesis computed harvest rates for Central Valley fall-run chinook salmon. NMFS has computed separate harvest rates on winter run chinook salmon on the basis of coded wire tag recoveries. CDFG evaluated coded wire tag recovery information from the Coleman National Fish Hatchery to determine an exploitation rate. Based upon this cursory analysis, the actual exploitation rates were consistently lower than the CVI harvest rate index by 10 to 20%. The methodology used by CDFG is based primarily on three-year-old fish which are fully vulnerable to the fishery.

One member of the work group questioned why there was so much of an emphasis on harvest rates. He noted there are other important factors such as sustainability of the

population and a complete assessment would evaluate all sources of mortality including man induced and natural mortality.

Based upon information from a coded wire tagging recovery group, the following data might be included in an assessment of salmon exploitation rates:

- Estimate of actual harvest.
- Estimate of non-catch mortality.
- Inland harvest and associated non-catch mortality.
- Illegally taken salmon.
- Estimate of natural mortality.
- Spawning escapement (including straying)
- Man induced mortality different than harvest.

While the CVI provides information on trends of harvest and abundance, additional harvest management tools are needed to address the reproductive capacities of the different stocks. The work group agreed that it would be useful to develop a new management tool separate from the CVI for managing the ocean fishery. Some of the new tools might utilize exploitation rates, genetic analysis, and ocean stock distribution.

Cohort Replacement Rates and Recovery Goals

CalFed is using fish population dynamics models to evaluate the CalFed restoration actions. These methods include a review of fishery population trend data, cohort replacement rates, and extinction modeling. The work group discussed the adequacy of using a cohort replacement rate > or equal to1.0 in meeting other goals such as the winter-run recovery goal or the CVPIA fish doubling goal. The CVPIA doubling goal was legislatively mandated and the State' goal is to double the fish population over the 1980 levels of abundance. The CalFed goal is to exceed the recovery goals and also to provide a sustainable harvest. Both of these goals need to be reviewed in terms of habitat carrying capacity.

For the purposes of evaluating the adequacy of other goals for meeting the ESA recovery goals, NMFS will review the adequacy of the existing regulatory requirements. Using escapement data from 1989 to 1993, NMFS computed the cohort replacement rate (CRR) for winter run chinook salmon and determined that a CRR 1.7 would provide an 80% probability that the CRR would be at least 1.0 in any given year. This targeted goal assumes recovery will occur by the year 2015.

The use of average cohort replacement rates by CalFed may be of limited value because a high CRR does not mean the population is in good shape. CRRs should be limited as indicators of how well we are managing the fishery and habitat and to examine trends in species abundance.

Additional Data Requirements

The work group discussed a number of areas where data could be improved for managing the ocean harvest. These data needs include the following:

1. A more comprehensive inland cwt recovery program.
2. Ocean catch distribution of weak stocks.
3. More complete carcass surveys to determine natural spawning escapement.
4. More accurate counts of hatchery fish escapement.
5. Estimates of harvest rates of stocks of management concern.
6. Studies to determine the size range and length frequency of jack salmon based upon scale samples from naturally spawning fish of different stocks or races.
7. Expanded DNA microsatellite marker research.
8. More accurate stock composition projections.

In addition to these data requirements, the following actions were thought to be beneficial.

1. Review the practice of trucking fish to the western Delta.
2. Don't allow surplus hatchery fish to spawn naturally or be returned to the river.
3. Expand cwt constant fractional marking programs.

Actions that Might Benefit the Recovery of Weak Stocks

The work group discussed the limitations of a selective fishery that would protect weak salmon stocks. For this program to work, the majority of the fish available for harvest would have to be hatchery fish. If there is not an abundance of hatchery fish, then too many fish would have to be handled in order to sustain a fishery. The estimated hooking mortality rate for sport caught released fish is 37% based on the use of barbless circle hooks in a mooching fishery. This hooking mortality rate could be further reduced by prohibiting mooching in recreational fisheries.

A "bubble fishery" could be explored as a method to protect weak stocks, however, other genetic markers are needed for the other salmon stocks before this method could be applied on a more wide spread scale. In 1997 a bubble fishery was conducted near San Luis Obispo and the fishery was shut down after only two days of fishing based upon the results from DNA microsatellite analysis which indicated fishermen were taking a substantial number of winter-run chinook salmon. The DNA microsatellite marker analysis provided a powerful tool to protect a weak salmon stock. One major limitation, however, with using just stock composition data for in-season management is that it still does not provide the relative strengths of the runs because the in-season data cannot be expanded to stock size.

The work group noted that ocean protections for spring and winter-run chinook salmon are possible because of life history time differences with fall-run, but San Joaquin fall-run could not be protected on a similar basis.

Summary of Existing Regulations

During the period from 1971 to 78, there were few changes to the ocean fishing regulations. The first major changes did not occur until 1979 in response to changes in Federal law. The next set of major changes in ocean harvest regulations occurred in 1983 in response to the need to meet tribal harvest allocations on the Klamath River. A copy of the summary of the fishing regulations is attached.

Anticipated Regulatory Changes over the Next 7 – 10 Years

While potential new regulatory actions were hard to define, the work group thought there would be greater specificity in the management of the ocean fishery. There may be more micro-management and new tools available to manage the fishery. Future regulations may be more flexible in time based upon ocean conditions. There may be increases in efficiency of fishing methods that will reduce the amount of bycatch (non-target species or races). The work group concluded that any evaluation of future fishing regulatory actions is really an evaluation of the regulatory process.

Contributions of Harvest Management Actions Towards Species Recovery

The work group assigned scores to the list of existing and potential fishing regulatory actions. (see attached table). The work group used the following scoring criteria:

1 –2 = Regulations are inadequate to contribute to recovery goals.
3 – 5 = Regulations may be sufficient to contribute to recovery goals.
6 –7 = Regulations will likely contribute to recovery goals.

The winter run goal in the scoring matrix is a de-listing goal. The recovery goals for spring-run and San Joaquin fall-run are from the Native Fishes Recovery Plan. In addition to these goals there are also CVPIA mandated doubling goals that go well beyond the ESA recovery goals.

The following assumptions were made in scoring the matrix:

- Genetic analysis can be used as a management tool on a post season basis only.
- Because of the lack of stock separation by time and area, selective fisheries offer few opportunities toward recovery of spring and fall-run chinook salmon
- Protection of winter, spring, and SJ fall-run chinook in a selective fishery relying on a 100% hatchery fish mark is based upon a target fishery on marked fall-run chinook salmon (few winter and spring-run chinook are tagged). There is a high assumed hook and release mortality with this option. This option would be expensive to implement but the group did not consider economics in their assessment.
- In scoring new regulatory actions, there is a high comfort level that the existing regulatory process will protect weak stocks.

The work group had diverse opinions over the adequacy of existing fishing regulations to protect San Joaquin fall-run chinook salmon. At least some members of the group felt that a much lower score was warranted based upon a dramatic decrease in abundance of San Joaquin River stocks between 1988 and 1991. Other members of the work group felt that this decline was due to drought conditions. This drought was statewide and may have equally affected all Central Valley chinook salmon runs.

Better Management Tools

To improve ocean harvest management, the workgroup discussed the following tools and data needs:

- Development of stock specific exploitation rates.
- More complete spawner carcass surveys. The discrepancy between the RBDD counts and carcass survey based estimates for winter-run chinook is one example to justify this action.
- Genetic based mixed stock fishery analysis.

While the development of stock specific exploitation rates may be a resource agency responsibility, CalFed should consider funding this task with existing Category III funds.

Life Cycle Models

In order to gain a better understanding of the interrelationship between harvest, habitat, and water management requirements, a life cycle model is needed. Current efforts to develop a life cycle model include the CPOP life cycle model, Pete Lawson is developing a habitat based model for coho salmon, and the IEP Salmon Work Team is developing a salmon conceptual model. More focused models on a given life stage include the USFWS salmon smolt survival model and the Newman Rice version of the same model. The CPOP model was developed to simulate changes in salmon population abundance in response to changes in habitat, toxics, and harvest. The model was never used and users were cautioned that they should not rely on the model output and the usefulness of the model is for comparison purposes only. An updated version of the model for all races of Sacramento River chinook salmon is currently under review by the USFWS (Wim Kimmerer, personal communication).

CONTRIBUTIONS OF HARVEST MANAGEMENT ACTIONS TOWARDS SPECIES RECOVERY

ACTION	WINTER RUN CHINOOK	SPRING RUN CHINOOK	SAN JOAQUIN FALL-RUN CHINOOK
Recovery/Restoration Goal	20,000 (10,000 females) (Delisting Goal)	8,000 Wild Spawners 500 Mill Creek 500 Deer Creek[1]	20,000 Median Escapement for Stanislaus, Tuolumne, and Merced[1]
Existing Fishing Regulations	**6,2**	**4,1**	**4,2**
New Regulations Over the Next Seven Years	**6,2**	**6,2**	**6,2**
Genetic Analysis	**7,3**	**6,2**	**6,1**
Selective Fishery (Time/Area)	**6,2**	**4,2**	**2,2**
Selective Fishery (100% Hatchery Fish Mark)	**5,2**	**5,2**	**6,2**
Improved Gear or Method & Use	**4,2**	**4,2**	**4,2**
Better Management Tools	**6,2**	**6,2**	**6,2**

Scoring Criteria:

1 – 2 = Regulations are inadequate to contribute to recovery goals
3 – 5 = Regulations may be sufficient to contribute to recovery goals
6 – 7 = Regulations will likely contribute to recovery goals

Levels of certainty are:

1 = low certainty
2 = moderate certainty
3 = high certainty

[1] From San Francisco Bay Native Fishes Recovery Plan

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